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given angle θ . What is the distance and what is the direction of the limiting point (if there be such) from the initial point of the first segment?

SOLUTION BY P. H. GRAHAM, Washington Square College, New York University.

Take the origin of rectangular coördinates as the initial point and let the first segment make an angle θ with the x -axis. Let X and Y be, respectively, the sums of the projections of the segments on the x -axis and on the y -axis; D the distance of the limiting point from the initial point and α the angle which the radius vector to the limiting point makes with the x -axis. Then

$$X = \sum_{k=1}^{\infty} \frac{\cos k\theta}{k}, \quad Y = \sum_{k=1}^{\infty} \frac{\sin k\theta}{k}, \quad D = \sqrt{X^2 + Y^2}, \quad \alpha = \tan^{-1} \frac{Y}{X}. \quad (1)$$

Setting $z = \cos \theta + i \sin \theta$, we have the known development

$$-\log(1-z) = z + \frac{z^2}{2} + \frac{z^3}{3} + \dots, \quad z \neq 1. \quad (2)$$

Hence

$$-\log(1 - \cos \theta - i \sin \theta) = \sum_{k=1}^{\infty} \frac{(\cos \theta + i \sin \theta)^k}{k} = \sum_{k=1}^{\infty} \frac{\cos k\theta + i \sin k\theta}{k}. \quad (3)$$

But $-\log(1 - \cos \theta - i \sin \theta) = -\log(2 - 2 \cos \theta)^{1/2} + i \tan^{-1}[\sin \theta / (1 - \cos \theta)]$ and, hence, equating the real and imaginary parts of (3), we have

$$X = -\log(2 - 2 \cos \theta)^{1/2} = -\log\left(2 \sin \frac{\theta}{2}\right), \quad Y = +\tan^{-1} \frac{\sin \theta}{1 - \cos \theta} = \frac{\pi - \theta}{2}. \quad (4)$$

Therefore

$$D = \sqrt{\log^2\left(2 \sin \frac{\theta}{2}\right) + \left(\frac{\pi - \theta}{2}\right)^2}, \quad \alpha = \tan^{-1} \frac{\theta - \pi}{2 \log\left(2 \sin \frac{\theta}{2}\right)}, \quad 0 < \theta < 2\pi.$$

NOTE ON THE ABOVE SOLUTION BY OTTO DUNKEL, Washington University—The angle θ may be taken so that $0 < \theta < 2\pi$, and the angle of $1 - z$, say ψ , may then be taken so that when $\theta = \pi$, $\psi = 0$, $-\pi/2 < \psi < \pi/2$. Inspection of a figure will show at once that $\psi = (\theta - \pi)/2$ and that the absolute value of $1 - z$ is $2 \sin(\theta/2)$, so that

$$\log(1-z) = \log(2 \sin \theta/2) + i(\theta - \pi)/2.$$

The development in (2) is valid for all points on the circle of convergence of the series except for the singular point $z = 1$. The proof of this may be found in Goursat-Hedrick, *A Course in Mathematical Analysis*, vol. 2, part 1, page 19, foot-note, where the convergence of the series is proved, while the argument on pages 20, 21 shows that the series converges to the value on the left in (2). See also pages 38, 39 in the same text for a treatment of $\log(1+z)$ which gives the above results by a simple substitution.

Also solved by AUGUSTUS BOGARD, R. E. JOHNSON, and ELIJAH SWIFT.

NOTES AND NEWS.

It is to be hoped that readers of the MONTHLY will coöperate in contributing to the general interest of this department by sending items to H. P. MANNING, Brown University, Providence, R. I.

Mr. C. C. PHIPPS, of the University of Montana, has been appointed instructor of mathematics at the University of Minnesota.

Miss MINNA SCHICK, instructor of mathematics at the University of Minne-

sota, has been appointed associate professor at the University of the Philippines.

Mrs. MARY W. NEWSON, associate professor of mathematics at Washburn College, has been appointed head of the department of mathematics at Eureka College, Ill.

At H. Sophie Newcomb Memorial College, New Orleans, Miss ANNA M. HOWE has been promoted to an assistant professorship of mathematics and Miss ANNA NANCY, of Tulane University, has been appointed assistant professor of mathematics.

At Hampden-Sidney College, Va., Mr. B. D. PAINTER has been appointed assistant professor of mathematics.

At Colorado College, Associate Professor W. V. LOVITT has been promoted to a full professorship. Miss WILHELMINA M. SPINGLER and Mr. A. R. WAPPLE have been appointed instructors of mathematics.

The Corporation of Yale University has recently raised the title of H. S. UHLER from the grade of Assistant Professor to Associate Professor. The latter rank was established at Yale only a year or two ago.

At the University of Southern California, Associate Professor H. C. WILLET has been promoted to a professorship in mathematics, and Dr. VICTOR STEED has been appointed an assistant professor.

At Albion College, Mr. LEON SEARS has been appointed instructor in applied mathematics and astronomy.

At the California Institute of Technology, Dr. CLYDE WOLFE has been promoted to an assistant professorship in mathematics.

Professor W. J. RUSK, Grinnell College, is absent on sick leave for the second half of the present year. He is spending the spring months at Whittier, California.

Mr. A. L. DIXON, fellow and tutor of Merton, has recently been appointed Waynflete Professor of Pure Mathematics in succession to Professor E. B. Elliott, fellow of Magdalen, resigned. Mr. Dixon has also been elected a fellow of Magdalen.

CHARLES HENRY DAVIS, 2nd, Rear Admiral, retired U. S. Navy, who was twice Superintendent of the Naval Observatory, died at Washington, D. C., December 27, 1921. He was born in Cambridge, Mass., August 28, 1845. His father, Charles Henry Davis, had also been twice Superintendent of the Naval Observatory and had established the Nautical Almanac Office.

WOOSTER WOODRUFF BEMAN, whose services to mathematics in America are known throughout the country, died at his home in Ann Arbor on January 18, 1922. He had been a member of the Faculty of the University of Michigan continuously since 1871, a record of service unequalled in the history of the University. Professor Beman was born in Southington, Connecticut, on May 28, 1850. He graduated from the University of Michigan at the age of twenty and during the following year taught Greek and mathematics at Kalamazoo College. In 1871 he returned to his Alma Mater as instructor of mathematics and in 1873

received the degree of Master of Arts. He became an assistant professor in 1874, an associate professor in 1882, a full professor and head of the department in 1887, a position which he held until his death. For several years before completing his half century of service he was the senior member of the Faculty. In 1908 he received the honorary degree LL.D. from Kalamazoo College. The series of text books that were prepared by Professor Beman in collaboration with Professor D. E. Smith of Columbia University included *Plane and Solid Geometry* (1895), *New Higher Arithmetic* (1897), *New Plane and Solid Geometry* (1899), *Elements of Algebra* (1900), *An Academic Algebra* (1902). The translation of Klein's *Famous Problems of Elementary Geometry* was an outcome of this same collaboration (1897). The *Michigan Alumnus* makes the following personal allusion:

"Professor Beman was a man of strong individuality, with a somewhat precise and even abrupt manner that only served partly to conceal a kindly and considerate disposition. He had an extraordinary memory and a gift for the details of knowledge particularly effective in his field of mathematics. Alumni who have returned to the University after long years of absence have found to their surprise that Professor Beman not only recognized them, but also remembered personal incidents of their college career. His interest in his former students was continuous and never failing, a characteristic which endeared him to everyone who ever sat in his classes."

Marie Ennemond Camille Jordan¹ died January 21, 1922. He was born in Lyon, January 5, 1838, and when he died he was "dans la plénitude de ses facultés." He entered the Ecole Polytechnique in 1855 and obtained his Dr. ès sciences in 1861. He was engineer of mines at Privas, Chalon-sur-Saône, then at Paris (1867). In 1876 he became professor at the École Polytechnique and suppléant at the Collège de France. In 1881 he succeeded Chasles in the section of geometry of the Académie des Sciences. He was vice-president of the Académie in 1915 and president in 1916. In 1920 he was elected a foreign associate of the National Academy of Sciences (America). Since 1885 he has conducted the *Journal de Mathématiques pures et appliquées*.

Jordan lost three of his six sons in the war and the oldest of his grandsons; "tous les quatre dans des circonstances héroïques." His wife also died 1918.

His most important books are *Traité des Substitutions et des Équations Algébriques* (Paris, 1870) and *Cours d'Analyse de l'École Polytechnique*² (three volumes, Paris, 1883–1887; 3d edition, 1909–1915). His reputation rests chiefly on his researches in the "Theory of groups" and their application to the solution of algebraic equations. He was also a pioneer in the modern theory of functions of a real variable, having introduced into this portion of analysis the important notion of function with limited variation. His name has been given to those curves which divide the plane into two distinct parts.

¹ There is an obituary notice by Villat, inserted in the first number for 1922 of the *Journal de Mathématiques* and accompanied by a fine portrait of Jordan. M. Villat is the successor of Jordan as editor of this journal. The address of Picard is included in this notice and is also published in the *Revue Scientifique*, February 11, 1922, pp. 95–96. The tribute by M. d'Adhémar is in the *Revue générale des Sciences pures et appliquées*, February 15, 1922, pp. 65–66.

² In 1890 at the Johns Hopkins University we learned from Craig to appreciate our "Jordan" (*Cours d'Analyse*) and in the years that followed, when difficulties arose in the "Theory of functions," it was to Jordan that we went for help.—H. P. M.

M. E. Picard, in the Academy of Science, on the 23d of January, gave an address describing briefly the work of Jordan and concluding with the following paragraph:

"Tous les travaux de Jordan dénotent une rare profondeur d'esprit et une extraordinaire puissance d'abstraction. Il se jouait au milieu des discussions les plus subtiles sur des concepts comme ceux de *groupes* ou de *substitutions*, se plaisant à aborder les questions dans toute leur généralité, comme s'il craignait que quelque particularité l'empêchât de voir les vraies raisons des choses. Jordan a été vraiment un grand algébriste; les notions fondamentales qu'il a introduites en Analyse préservent son nom de l'oubli."

The following incidents given in a tribute from the pen of M. R. d'Adhémar show something of Jordan's character:

"Je parlais, un jour, avec M. Jordan, du travail considérable que demande la publication d'un cours, parce qu'il est impossible d'avoir, sur *toutes* les questions, des vues personnelles.

"Etant, un jour, embarrassé—me répondit-il—j'allai me renseigner auprès d'Henri Poincaré, *notre maître à tous!*

"Je n'oublierai ni ce trait, ni l'impression presque enfantine de bonté et de douceur, que je lisais, à ce moment, sur le visage de M. Jordan. Ce vieillard illustre parlait, avec respect, d'un confrère beaucoup plus jeune que lui! Je suppose qu'Henri Poincaré a aussi, parfois, demandé des renseignements à Camille Jordan.

"Chargeé d'honneurs, M. Jordan était infiniment modeste, bienveillant, juste et ferme. Son caractère était remarquablement pondéré; il y avait autant de force que d'équilibre dans cette belle tête! . . .

"Savant génial, M. Jordan a été un homme dont la haute dignité morale était universellement respectée.

"L'homme était aimé et l'œuvre sera toujours admirée."

M. H. Villat, after writing of the griefs that came to him in the war, adds:

"Dans ses convictions religieuses, auxquelles il était depuis son enfance profondément attaché, il sut trouver un réconfort et un appui; il restait entouré de la chaude affection des siens, s'occupant d'ailleurs beaucoup des études de ses petits-enfants, ce que son érudition, étendue dans tous les domaines, lui rendait facile; ses lectures étaient innombrables, et même les classiques grecs et latins, dans le texte original, n'avaient pas de secrets pour lui.

"Trop brièvement, j'ai dit ce qu'a été la vie admirable de Jordan. Ce que je n'ai pas dit et ce dont tous ceux qui l'ont approché dans l'intimité pourront témoigner, c'est l'extrême délicatesse et l'infinie bonté avec laquelle il savait traiter ses amis. N'attachant pour lui-même qu'un prix médiocre aux honneurs, il ne s'épargnait nulle peine pour les faire obtenir, à leur insu, à ceux qu'il en estimait dignes; et ce trait, entre mille autres, explique la profondeur des affections qui s'étaient multipliées autour de lui."

At the University of Cambridge, England, a special syndicate appointed by the University has reported in favor of the addition of mathematics to the list of subjects for the Natural Sciences Tripos, Part 1. This attempt to facilitate the acquisition of mathematical knowledge by students of the natural sciences will be of interest to teachers of mathematics in our colleges and universities.

At the annual meeting of the Mathematical Association of Great Britain, January 2-3, 1922, Sir T. L. Heath was elected president as successor to Canon J. M. Wilson. The new president is well known through his publications *The Thirteen Books of Euclid's Elements*, 3 volumes, *The Works of Archimedes*, *Diophantos of Alexandria* etc., all published by the Cambridge University Press.

The University of Nebraska will offer three or four fellowships in mathematics for the year 1922-23. The applicant must have the Bachelor's Degree

from some college or university of recognized standing. Some teaching experience is also desirable. These fellows will be required to teach part time, and the compensation will vary from \$500 to \$1000.

A National Academy on the model of the Institut de France is being founded in Ireland. There are five sections or academies, one of which is devoted to the mathematical and physical sciences. A foundation meeting was scheduled for May 18, 1922. In the Mathematical and Physical Section twenty-two persons were invited to be foundation members, among these being Professor F. D. Murnaghan of the Johns Hopkins University. The Academy has received the promise of financial support from the Department of Education of the Irish Free State and it will encourage and publish the results of research submitted by its members and associates.

At the annual meeting of the National Academy of Sciences, on April 24, 25 and 26, the following papers were presented: "Some extensions in the mathematics of hydromechanics" by Dr. R. S. Woodward; "Normal coördinates and Einstein space" by Professor G. D. Birkhoff; "Algebraic solutions of Einstein's cosmological equations" by Professor Edward Kasner; and "Geometry of paths" by Professor Oswald Veblen. At this meeting Professor L. P. Eisenhart was elected to membership in the National Academy.

The following abstract from a letter of the Ohio Section will perhaps also express the ideas of the executive committees of other Sections: Our Section can never reach its highest development by the efforts alone of the officers, or any program committee—the most vital ideas come from you members. Each member has an obligation to help promote the usefulness of the Section. You know that merely buying a book does not make it your intellectual property. Neither does merely paying your dues to a scientific society gain you a great part of its benefits. To be the best possible Section our members must not only be "in" it, they must also be "of" it. Now give some thought to your State Association. Let the secretary have the benefit of your suggestions. He will see that they get very careful attention. Let us begin now to plan for next year's program.

THE NATIONAL COUNCIL OF MATHEMATICS TEACHERS.

The National Council of Mathematics Teachers held its annual meeting at Chicago on March 1st, 1922, in connection with the meeting of the Department of Superintendence of the National Education Association. At the business session in the morning, matters of policy for the development of the National Council were discussed, and these matters were set forth by President Minnick at the dinner in the evening. It seems logical and desirable that the Council should in a sense continue the work of the National Committee on Mathematical Requirements, which is about to complete its formal work. For this purpose, as well as for many other reasons, it is desirable that the National Council should double, or even quadruple, its present membership of twenty-seven hundred, and a campaign for that purpose will be undertaken at once.

At the afternoon session Dr. J. M. Kinney gave a paper on "The function concept in high school mathematics"; Professor H. E. Slaught discussed the question of "Elective courses in senior high school mathematics," in place of Professor E. R. Hedrick, who was unable to be present; Professor J. W. Young gave a report on "Some phases of the work of the National Committee"; and Mr. Alfred Davis discussed "Unsettled problems concerning the teaching of secondary mathematics." At the evening meeting following the dinner, at which over two hundred members were present, Professor H. E. Slaught presided. The speakers were Mr. W. D. Reeve, who spoke on "The case for general mathematics"; Professor G. W. Myers, on "Reaction versus radicalism in teaching secondary mathematics"; Mr. Raleigh Schorling, on the question "Is the teaching of mathematics responding to modern demands in secondary education?"; and President J. H. Minnick, on "A program for the National Council of Teachers of Mathematics."

It was universally agreed that this was the most successful meeting of the National Council which has been held.

IMPORTANT ANNOUNCEMENTS

1. The Seventh Summer Meeting of the Association will be held at the University of Rochester on Wednesday and Thursday, September 6-7, 1922. The first session will be devoted to a symposium on the progress of unified mathematics, comprising four papers, "The problem of organizing freshman college courses" by Professor J. W. Young of Dartmouth College, "Historical consideration of unified mathematics" by Professor L. C. Karpinski of the University of Michigan, "Some aspects of unified mathematics for freshmen" by Professor R. W. Burgess of Brown University, and "Internal reasons for unification" by Professor C. E. Comstock of Bradley Polytechnic Institute, followed by discussion led by Professor F. B. Williams of Clark College and Professor K. D. Swartzel of the University of Pittsburgh.

The second session will consist of papers as follows: "Contradictions in the literature of group theory," presidential retiring address by Professor G. A. Miller of the University of Illinois, "An English text on mathematics written about 1810" by Professor Elizabeth B. Cowley of Vassar College, "Impressions of mathematics and mathematical instruction in Italian universities" by Professor Virgil Snyder of Cornell University, and "The present status of the formal discipline controversy" by Professor N. J. Lennes of the University of Montana.

Thursday morning will occur a meeting at the Research Laboratory of the Eastman Kodak Company by invitation of the Company. At this meeting a paper will be read, "Mathematical puzzles as an introduction to investigation" by Professor W. B. Carver of Cornell University, and a paper by Doctor L. A. Jones of the Eastman Kodak Company, followed by an inspection of the Research Laboratory and a business meeting.

[Mar.,

2. There have been elected to membership since the last printed report 88 individual members and 6 institutional members. The names of those elected at the Toronto meeting are given in the Secretary's report in this issue. The names of all new members elected since the last Register was printed will appear in the new Register soon to be published.

3. Amendments to the By-Laws and Articles of Association will be discussed and voted on at the Rochester meeting. Aside from the elimination of certain paragraphs now obsolete, and the simplification of other portions, four explicit changes will be proposed:

(a) To add one new officer—a librarian;

(b) To provide for notification of proposed amendments *by mail* to members as alternative to publication in the *MONTHLY* and to make this operative in the present case;

(c) To provide for a life membership clause, on which a committee of the Association has already been making a careful study;

(d) To provide for the management of other publications than the official journal, e. g., the Carus Monographs.

It is also proposed to amend the Articles of Association of the corporation so as to increase the number of Trustees from 19 to 20.

4. The report of the committee appointed to nominate an editorial board for the Carus Monographs and to formulate a statement of powers of this board has been presented to the Trustees and approved by their mail vote. A copy of this report has been sent to each member of the Association. It will be presented for formal ratification by the Trustees at the Rochester meeting and will appear as a part of the Secretary's report of that meeting in the *MONTHLY*.

5. The printer now gives assurance that the issues of the *MONTHLY* can be handled with something like normal speed, and we hope to catch up on the schedule during the autumn.

W. D. CAIRNS,
Secretary-Treasurer.

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